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National Park Service Paleontology Program

Oral History Interview – Lloyd Logan

Natural Resource Report NPS/PALEONTOLOGY PROGRAM/NRR—2020/002

ON THE COVER
Paleontologist Lloyd Logan removing *Euceratherium* skull from Musk Ox Cave, in Carlsbad Caverns National Park.

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February 2020

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

V. L. Santucci. 2020. National Park Service Paleontology Program: Oral History Interview – Lloyd Logan. Natural Resource Report NPS/PALEONTOLOGY PROGRAM/NRR—2020/002. National Park Service, Fort Collins, Colorado.

NPS 2020/002, February 2020

Background

This document includes the transcript for the oral history interview conducted with paleontologist Lloyd Logan on Friday, February 5, 2020. The interview was coordinated by Vincent L. Santucci, NPS Senior Paleontologist over the telephone, with Lloyd at his home in Price, Utah. The interview was audio recorded and a digital mp3 file was produced and will be archives with the transcript and signature release form.

Lloyd's interview was undertaken as part of the Carlsbad Cavern National Park Paleontological Resource Inventory. During the early 1970s Lloyd was involved with field work at Guadalupe Mountains National Park involved with work in Upper Sloth Cave, Lower Sloth Cave, and Dust Cave. Lloyd was directly involved with the collection of the specimen of *Euceratherium* and other vertebrate fossils from Musk Ox Cave which is within Carlsbad Caverns National Park. Lloyd also visited and made fossil collections from Wen Cave and New (Slaughter Canyon) Cave in Carlsbad Caverns National Park.

This interview transcript was reviewed by Lloyd Logan to ensure accuracy of information and appropriate spelling is presented. If present, PII has been omitted.

Transcript

[START OF INTERVIEW]

Vince Santucci: Very good. Are you ready to go?

Lloyd Logan: Whenever you are.

Vince Santucci: Okay, super. Well, thanks so much. Today is February 5th, 2020. My name is Vince Santucci, I'm the National Park Service Senior Paleontologist based out of Washington DC and we're interviewing Lloyd Logan as part of our paleontology inventory at Carlsbad Caverns National Park. Lloyd will share some information about his work at both Carlsbad Caverns and at Guadalupe Mountains National Park as a paleontologist. Thank you so much Lloyd, for your time.

Lloyd Logan: My pleasure.

Vince Santucci: So, the first question that I have is very basic one, when and where were you born and where did you grow up?

Lloyd Logan: I was born in Florida. I grew up in Kansas and Missouri and, well before that I had lived in almost every coastal state. My father was a Navy instructor pilot.

Vince Santucci: Very good. He's a World War II vet?

Lloyd Logan: Yes.

Vince Santucci: Pretty good. Thanks for service. In terms of your education where did you do your schooling?

Lloyd Logan: Went to high school at Plattsburg, Missouri went to Northwest Missouri State which is now Northwest Missouri State University and got a bachelor's degree in biology with a specialization in wildlife and got a master's degree at Texas Tech with a master's in geology, specializing in vertebrate paleontology and a minor in biology.

Vince Santucci: And who did you work with as a student?

Lloyd Logan: At Northwest Missouri State, Dr. David Easterla who did a lot of work on bats in Big Bend National Park and as a graduate student I worked with Dr. Craig Black and Dr. Patricia Vickers-Rich.

Vince Santucci: Great. Thank you. Very general question, do you recall your first interest in paleontology and what led you to pursue a graduate degree?

Lloyd Logan: My first interest in paleontology came with a Christmas present in 1957. It was the book *All About Dinosaurs* by Roy Chapman Andrews and within a year, I had decided that I was going to be a biologist or a paleontologist and ended up being both.

Vince Santucci: Outstanding. I think a lot of people read that book and were inspired. And then a similar question your first interest or experiences with caves?

Lloyd Logan: Well, my first experience with a cave was a little bluff in eastern Kansas that had little cave underneath it, and my father had grown up in that town and knew about it and had expressly forbidden me to go in there. Like most kids when you're expressly forbidden, you do it anyway. It wasn't very deep, maybe 50, 75 feet, something like that, but it was pretty fascinating. And then when I got in college a couple of friends that were taking mammalogy with me wanted to go on a bat collecting trip to Southern Missouri and we just got a hold of the book *Caves of Missouri* by J Harlan Bretz and picked a couple of caves at random and went down there and went caving and found a few bats for the collection for Northwest Missouri State.

Vince Santucci: Very good. Your graduate research work, how did that come to be and what was the topic?

Lloyd Logan: My graduate research work, I was very interested in the Pleistocene. I was originally going to work in Lake of the Ozarks Region because my father-in-law had a cabin there and a pontoon boat so I would have a place to stay and access to the lakes and there's a lot of caves in area. And as I was proposing where I wanted to go, my major professor mentioned that there was potential for grants if I would work in Guadalupe Mountains National Park as part of the initial inventories in the park and so that was a lot closer to where I lived in Lubbock. I decided that that would make a lot more sense. Plus, the fact that I could get funding didn't hurt anything.

Vince Santucci: Great. That ties to my next question. I was curious how you got involved with work in the national park. So, it sounds like you've addressed that, but if you want to address that any further.

Lloyd Logan: Basically—excuse me. Basically, that was how I got involved in working in the national park. I had gone down to Guadalupe Mountains on a field trip with the—Hello?

Vince Santucci: Hi, Lloyd. I think I lost you there for a second.

Lloyd Logan: Yeah, we got disconnected somehow.

Vince Santucci: I think we left off when you were talking about going on a field trip to Guadalupe.

Lloyd Logan: Okay. Yes. Shortly after I got to Texas Tech, I joined the Texas Tech Geology Club and we went on an overnight field trip to Guadalupe Mountains National Park and did a hike up McKittrick Canyon and I was fascinated by the areas, my first experience with the

Chihuahuan Desert and then McKittrick Canyon being a riparian woodland in the middle of the desert, it was incredibly beautiful. I just really wanted to work in that area.

Vince Santucci: And before we go into more detail regarding both Carlsbad and Guadalupe Mountains National Parks, have you done any field work, paleontological or geologic in any other National Park Service area?

Lloyd Logan: No. Just those two.

Vince Santucci: Okay. Alright. So perhaps, maybe we can start with either one. Chronologically, would it make more sense to start with Guadalupe or Carlsbad?

Lloyd Logan: Chronologically, with Guadalupe.

Vince Santucci: Okay. So, do you want to just give me a general sense of what you were involved in at Guadalupe Mountains National Park?

Lloyd Logan: Okay. Late fall of 1973 or early spring, I don't remember the exact dates, but it was in the winter sometime, I contacted Guadalupe Mountains National Park and expressed an interest in doing some paleontological work there for a master's degree. I got hooked up with Ron Kerbo and we did several day, I think two or three-day trip down there for me from Lubbock and we hit I think, 10 different caves that we checked and I just did a surface walk and looked at the structure of the cave and evaluated whether I thought I could find vertebrate fossils in them or not. One thing that was interesting is that every cave I was in had vertebrate fossils in them.

Lloyd Logan: Some of them had more than others and some were more accessible than others, but every cave had the potential to have something in there. The caves that interested me the most were on the west face of the Guadalupe Mountains. They were Upper Sloth Cave, Lower Sloth Cave and Dust Cave. They had been excavated by an archeologist and I can't remember his name, I think in the 30s and there were a couple of test trenches in there. And from their old test trenches, I found boluses of ground sloth dung, *Nothrotherium* or *Nothrotheriops*, depending on which year you read the information and was fascinated by the fact that there were ground sloth there at one time and thought the potential might be there to find ground sloth bones. So those two caves, Upper and Lower Sloth Caves both had ground sloth droppings in them. Dust Cave as I recall, did not have any, or had very few. It was a much smaller cave, but Upper and Lower Sloth Caves both had significant numbers of vertebrate remains on the surface. So those were the two caves that I chose to work.

Vince Santucci: By chance, do you recall the names of the other caves that you visited?

Lloyd Logan: One was Hunters Well, Goat Trap. I think those are the only two that I can remember the names of. There was another cave that had a lot of sign in it from Barbary sheep that were feral in the area and I don't remember the name of it, but I remember giving, I think I was the first biologist to actually physically see a sheep in that cave. I went in there one day and they came boiling out of the cave and so I gave the information to the Park Service about the fact

that they were bedding in that cave because there was an active program trying to eradicate them in the area at the time. So you might be able to find something in the records on that.

Vince Santucci: Okay. I'm going to name just a couple of other caves and see if they sound familiar to you. Burnet Cave?

Lloyd Logan: No.

Vince Santucci: Spelled B-U-R-N-E-T.

Lloyd Logan: Yeah, I'm familiar with the cave I just haven't visited it.

Vince Santucci: Okay. William's Cave.

Lloyd Logan: Again, I'm familiar with the name but I haven't been there.

Vince Santucci: Okay. How about Pratt Cave?

Lloyd Logan: Yes, I was in Pratt Cave.

Vince Santucci: Okay. I think those are pretty much the main caves that are there outside of the ones you've already mentioned. Perfect. Thank you. That's good recall from so long ago.

Lloyd Logan: Yeah. I was dredging it up from my toenails.

Vince Santucci: That was ‘73, ‘74 time period?

Lloyd Logan: Yes.

Vince Santucci: Okay. Alright. The focus of your work then was primarily at three caves, Upper Sloth, Lower Sloth, and Dust Cave.

Lloyd Logan: That's correct.

Vince Santucci: Maybe you can start with Dust Cave, what do you recall about your work at Dust Cave?

Lloyd Logan: Okay. Dust Cave was the least productive of the three caves up high on the west face, north of the William's Ranch. There was very little deposit in the cave. As I recall, there was, I'll say less than say 15 to 20 centimeters of dust before you got to sterile ground where there was absolutely nothing. And there was very little in the materials above in the areas where I did the test trenches. It seems like I got a couple of a few pine needles out of there and some *Neotoma* jaws and that's the only thing that I can remember getting out of there. Like I said, it was a sterile environment. I may have gotten a few reptile bones out of there too. The reptiles that I did get out of all three caves, I gave to Tom Van Devender at the University of Arizona to

identify, and he gave a presentation on them at the first Biology of the Guadalupe Mountains Symposium.

Vince Santucci: Great. And then I guess starting with Upper Sloth Cave your work in that cave.

Lloyd Logan: Okay. Upper Sloth Cave was the first one that I did in the summer of 1974. I got there late May, early June, and spent three months at the cave. David Bohaska, who's at the National Museum of Natural History now or at least was a couple of years ago, was my field assistant that first year. And we excavated... I'm trying to remember, several test trenches, I think three or four test trenches in the cave. We picked up some fossil wood that the University of Arizona people did a radiocarbon date on and got a number of sloth dung boluses out of our trenches. And let's see, we had a lot of plant material too, a lot of spruce needles and things like that that were also done by the Arizona crew. Geoff Spalding was, I believe, the one that worked on the fossil plants G-E-O-F-F, Geoff Spalding.

Lloyd Logan: Tom Van Devender, as I said, did the reptiles from there, I did the birds and mammals and that was published in the symposium volume, the first symposium on the Biology of the Guadalupe Mountains. So it was interesting. The most productive site was a little crevice to the right of the opening as you went in, that had an opening up high on the plateau above the cave. And it was apparently either a place for small carnivores, like skunks and *Bassariscus*, where they would go in and relieve themselves or a place where owls had set above and cast out pellets or maybe both. The breakage of the bone was consistent with both of them, but that was where I got the vast majority of my smaller species. All of the trenches that I did in the caves up there, I lined with plastic to the extent of my excavation and then put an aluminum film can with my name and the dates and the pack that I was with Texas Tech in there and then backfilled so that any future researcher could see the extent of my excavations and know where the material went.

Vince Santucci: Very good. And as far as you know, all the collections from Upper Sloth, Lower Sloth, and Dust Cave, they're all at Texas Tech?

Lloyd Logan: As far as I know, they're all at Texas Tech. They were when I left. I know at one time Texas Tech was thinking about eliminating the vertebrate paleontology program and my professor, Dr. Craig Black borrowed all the specimens and took them with him to New Mexico where he was living at the time, but after they hired a paleontologist again, he shipped or delivered all the specimens back, to my knowledge.

Vince Santucci: Do you recall the names Upper and Lower Sloth Cave already exist by the time that you were working there or were you involved in naming any of the caves?

Lloyd Logan: They had another name, I don't remember what it was, but someone else had mentioned that there was sloth dung in there and so I think they were called Upper and Lower Sloth Cave when I was there. It seems like they were maybe... I'm just trying to dredge up the numbers. It seems like there're a number 04, 05, 09, naming the cave inventory for the park and I don't know if that's right or not. I'm pretty sure about the nine, but the four and five, I'm not too sure. I think nine was Dust Cave.

Vince Santucci: Alright. Any other thoughts in regards to Upper Sloth Cave in your work?

Lloyd Logan: Upper Sloth Cave, if someone else wanted to go in and do extensive excavations in there would undoubtedly supply a lot more vertebrate material. I found vertebrate material in every test trench I put in there. And my test stretches were just meter square grids, went down to bedrock, or to sterile material. And in every one of them I found information that was valuable in terms of determining what was going on. I think the title I used was Paleo-climatic Implications of the Vertebrate Fauna of Upper Sloth Cave, Guadalupe Mountains National Park, Texas.

Lloyd Logan: I think that was what I used for the symposium title. And I did find a couple of agave quids where the Mescalero Apache had roasted agave and then chewed them up and sucked on the leaves, sucked the juices out and I did find a couple of those in the trenches and those are also at Texas Tech. I believe that those may have gone to the archeology department. I know the archeologists came over and looked at them, I don't know whether they were transferred or not or whether they remained with the Vertebrate collections.

Vince Santucci: Great. Thank you. And then can you provide information about your work at Lower Sloth Cave?

Lloyd Logan: Okay. Lower Sloth Cave, I did part of the excavations in 1974 and the balance of them and 75. My research assistant that summer was a graduating high school student from Liberty, Missouri named Butch Hickman. We put in somewhere around seven or eight, something like that, test trenches in total over the two summers, found material everywhere in the cave, a lot of vertebrate material. That one we found more sloth dung in that cave than in Upper Sloth. It's a more protected cave, might be had been used in the winter as a place to get out of the cold air. One area that I wanted to excavate and ran out of time before I got there, there's a little chamber in the back, on the back left that you have to basically do a low crawl you might even have to dig your way into it to get a bucket in there so you could carry material out, but it would be a perfect place for a den for a carnivore to have its young and I never got back in there to put a test trench in there.

Lloyd Logan: So, that might be something if somebody wants to work on it in the future, would be a good spot. I mapped Upper Sloth, Lower Sloth and Dust Caves with Dennis Moore and I can't remember the other student's name, he was a biology student at Texas Tech at the time and we went down there and mapped all three of the caves. I know I gave copies to the Park Service, I have no idea where they went, but I gave copies to the Park Service and then I had published in the papers, I published on both of those two caves, I had a map in both of those. The Upper Sloth Cave was in the symposium the Lower Sloth Cave was published in the NSS Bulletin, probably of the 82, 83, 84 somewhere in that range.

Vince Santucci: Yeah, I found that just the other day based on your email and so I had a chance to look at that so thank you.

Lloyd Logan: Sure.

Vince Santucci: Any other cave paleontology related work at Guadalupe Mountains National Park?

Lloyd Logan: No. That was all I did.

Vince Santucci: Okay. So moving on to Carlsbad before we discuss Muskox Cave, had you had the opportunity to work on fossils from any other caves in Carlsbad?

Lloyd Logan: I did drop into Wen Cave with Ron Kerbo one time. It wasn't as productive as I had thought it might be just from the configuration of the cave it looked like it ought to be a treasure trove, but there were very few deposits in the bottom, they were very shallow so I didn't pursue that one at all. I believe, if my memory is right, I found a Pleistocene black vulture humorous on the surface and there *Coragyps occidentalis,* and that should be at Texas Tech unless it's in the park collections. I can't remember whether I took with me or whether Ron took it and put it in the collections there at Carlsbad. And I did find some *Neotoma* jaws, wood rat. Wood rats were found in every cave that I looked in the Guadalupe Mountains Service, wood rat remains.

Vince Santucci: Were the sedimentary deposits, were they stratified, was there any stratigraphic context to them?

Lloyd Logan: Not that I could tell in Wen Cave, it looked like it was all just a uniform natural weathering breakdown. There didn't appear to be any major influx, like a storm or water coming in or something from an old cave system that had been broken into. My personal thought is that at some time in the past, Wen Cave and New Cave were a continuous cave, with their proximity and the orientation of it, I think that there was a good chance of that, but that's just my opinion. I don't claim to be a geomorphologist that explains how caves are formed.

Vince Santucci: So, any paleontological remains that you recall from the main Carlsbad Cavern itself?

Lloyd Logan: No, I haven't done any work in there at all. I took a couple of tours through there and went back behind the scenes once with Ron Kerbo, but I never picked up anything in there and I don't recall even seeing anything in there that hadn't already been pulled out.

Vince Santucci: Were you aware of some of the mummified remains of bats in the Carlsbad system?

Lloyd Logan: Yes, I had heard of them. I think Ron even showed one of them to me, but I didn't pick any of those up. On the same regard, I did take a tour of New Cave with Ron and the bat guano deposits there that are, I don't know, it seems like they were eight or nine feet thick, I almost wished I had done a master's thesis on that and done a stratigraphic evolution of the bats in the system right there because there were so many bat bone sticking out of that guano that it would've been a fascinating study. So that might be something somebody else can do someday if they haven't already.

Vince Santucci: Yeah. I had a chance to visit that locality. It's just an incredible, there's probably millions of bat bones that are—

Lloyd Logan: Yes. Yeah. It's phenomenal. It really is.

Vince Santucci: And do you know that cave also as Slaughter Canyon Cave or was that name not used?

Lloyd Logan: Yeah, I knew at first a Slaughter Canyon Cave and I think... I'm trying to remember where I heard that, I think it was in literature somewhere, they talked about Slaughter Canyon Cave. And then when I went up there, I think it had just been called New Cave for a couple of years when I was there.

Vince Santucci: Okay. So Lechuguilla Cave then, it's discovery that came after your work?

Lloyd Logan: Yeah. They discovered Lechuguilla Cave. Yes, it was after my work there. So it sounds, from what I've read, Lechuguilla's a fascinating system.

Vince Santucci: It certainly is. Other than Muskox, any other caves where you've encountered paleontology within Carlsbad Caverns National Park?

Lloyd Logan: Goat Trap Cave was loaded with goat remains and my feeling was that since there were a lot of domestic or feral goats in there, it was probably a good natural trap also. I don't even remember why it was, I decided I didn't want to work and Goat Trap. There were a lot of remains there.

Vince Santucci: Okay. In regards to the big one, Musk Ox Cave, were you part of the discovery and exploration of that cave or had it been already observed prior to your work?

Lloyd Logan: Cal Welborn sent me a photograph of the musk ox in the pool. Well, Ron may have been the one that sent it, but it was Ron or Cal sent me a picture of that and I went over the next weekend and dropped down in there with Ron and pretty sure Cal was there too. And we went down in there and I took a look at that and photographed it myself to get different angles. And then I sent the photographs to Dr. Clayton Ray at the Smithsonian, who I had done volunteer work with while I was in the army, and tentatively identified it as *Preptoceras sinclairi* and he wrote me back and said that my identification was right on and it was the most complete skeleton of its kind known and it should definitely be excavated. And that was where I thought it would end that somebody else would excavate it because I was working on my thesis.

Lloyd Logan: All I had left to do is to write my thesis at that time. And then I didn't have any support from the museum that summer. Craig Black had moved on to the Carnegie Museum at that time so if your major professor leaves, your funding leaves too. So I had gone to Missouri to work iron, I was an iron worker, my dad was an iron worker, so I worked iron in the summers to pay for my college until I got in graduate school. So I went back up there and got a call at my parents' house from Clayton Ray, and he wanted me to meet him and Arnie Lewis the next week down at Carlsbad. I think that was on July 4th, I got the call.

Lloyd Logan: He wanted me to meet him and Arnie Lewis at Carlsbad the next week and for me to help them with the excavation of this muskox. He wanted me to do the in-cave work since Arnie wasn't a vertical caver and he wasn't doing caving anymore since he had a lung problem from caving in Florida. So I agreed and met him down there and that's what got me into the mix with everybody.

Vince Santucci: Your first visit into Musk Ox, your first time seeing the skeletal remains and the photos you took, what was your general impression of that skeleton?

Lloyd Logan: It was incredible. It was completely covered with flowstone. It looked like it was made out of coral, but it was just lying there in the pool, just with very few... Well, a few of the bones were scattered, but most of the bones were more or less articulated and it was just a spectacular fossil. And then you look around that room, the debris slope in that room where it was at the bottom in this little pool and as I recall, there were horse and dire wolf, probably camel remains as well. It was just obviously a treasure trove for a paleontologist.

Vince Santucci: Yeah. When Ron first sent me the photos of the in situ specimen, I have to say it's one of the most beautifully preserved fossil specimens I've seen anywhere.

Lloyd Logan: Yeah. It was spectacular.

Vince Santucci: There's lots of directions to go now, the first question is that what are your thoughts in terms of how that assemblage of fossils wound up in Musk Ox Cave?

Lloyd Logan: Okay. That assemblage, I am 90% certain that that breakdown slope that led down to that pool was a former opening to the surface. And I think that the animals either smelled water and were trying to get to it and fell in, or they could have been panicked by nearby a carnivore, or maybe just walked into it in the night or whatever, but it was –I think it was a natural trap, just a sink hole and I think that they were just trapped in there and I think that the carnivores that were in there were probably attracted either, to the sounds of the animal down there in distress with a broken leg or whatever from the fall, or from the smell of the rotting flesh.

Vince Santucci: Very good. So when you got a call from Clayton Ray, had you spoke with Ron Kerbo about the possibly collecting the material and did Ron have any thoughts about that?

Lloyd Logan: I hadn't talked to him at all about that. I wasn't even thinking about me being involved in the collecting of it, I just told him that I thought it was a spectacular fossil and that it was really worthwhile to do something with it and then I just turned it over to Ron and Clayton and they ran with it from there.

Vince Santucci: And just for a chronologic context, do you recall approximately when it was your first time into Muskox Cave?

Lloyd Logan: It would've been probably late April, early May of 1976.

Vince Santucci: Okay. So it was after your work in the Guadalupe Mountains?

Lloyd Logan: Yes.

Vince Santucci: Okay. And you had indicated that Dave Bohaska had helped you with some work, one of the sloth caves and so—

Lloyd Logan: Yeah, he—sorry, go ahead.

Vince Santucci: No, go ahead.

Lloyd Logan: I was just going to say yes, he was my field assistant the first year because the Park Service didn't want me to be in there by myself which is understandable considering where it's at and so we excavated the Upper Sloth Cave and got started on Lower Sloth Cave with his assistance.

Vince Santucci: Was Dave at the Smithsonian at the time or was he still a student?

Lloyd Logan: He was a student at Texas Tech. He was a student of Patricia Vickers-Rich, and he was getting his master's degree working on fossil whales, but he needed money and Pat didn't have any money for him, so he worked for me.

Vince Santucci: This is just serendipitous, the first time that I was able to take a look at the remains from Musk Ox Cave, it was Dave who showed them to me at the Smithsonian, since he was working there at the time. Dave wasn't in Musk Ox Cave at all, though, he was only at Guadalupe?

Lloyd Logan: No. As far as I know, he was never in Musk Ox Cave.

Vince Santucci: Okay. Very good. So then you received a call from Clayton Ray and so you actually met with them at Carlsbad.

Lloyd Logan: Yes.

Vince Santucci: Okay. And—

Lloyd Logan: Yeah, I met him down there at the park a week later and there were a number of people from Cave Research Foundation there and we went out to the cave and Clayton said basically, "Get that one out of there," and I went down and we hauled in plaster and burlap for some of the bones, most of them we didn't most of them were just in good enough shape that we could just bring them out and let them dry a little bit and they hardened that way. The skull... I'm trying to remember whether we jacketed it or not, but I remember climbing alongside and guiding it through the boulder choke as they pulled it up from above and it had to be twisted and turned to go through there without banging around on things.

Lloyd Logan: And then when I got to the surface, that was the last load to come out that day. I got to the surface and I was mentally and physically exhausted from this worry about damaging this incredible fossil and threw my rope into my backpack and my caving gear in there and picked up my backpack and put it on, it was all I could do to pick it up, I was so tired, I got down the hill, got back to the Cave Research Foundation building in Carlsbad, dumped everything out of there to clean it up and there was a piece of limestone in there that probably weighed 25 pounds that Cal Wellborn had put in there and I had no idea he had put it in there, I didn't even look, I just threw stuff in there, so I carried that silly rock out of there.

Vince Santucci: Oh, my goodness.

Lloyd Logan: So I wrote Cal Welborn's name on it and put it in a bookcase there in the Cave Research Foundation building in Carlsbad and told Cal that some year he would find that in his backpack. Unfortunately, I've never been able to fulfill the promise. So that was a funny bit of history.

Vince Santucci: Oh, that is. Yeah thanks for sharing that. So yeah, that was one of my questions, but I think you covered that very well. I was going to ask you the challenges of trying to remove the material and safely get it out of the cave. That had to be quite an undertaking.

Lloyd Logan: Yes, it was. Every time we sent material up, I climbed up with it, either I or Kerbo or one of the Cave Research Foundation people climbed up. I climbed up with almost everything. I would've personally climbed with all the skulls just because I wanted to make absolutely certain that they got up in good condition. But yeah, it was that boulder choke at the top that you have to go through is not conducive for hauling the brittle vertebrate fossils through without having them being protected.

Vince Santucci: How many trips did you make up and down?

Lloyd Logan: I don't know. We took stuff up in batches so probably seven or eight trips up and down.

Vince Santucci: Wow. And did you say Clayton did actually get into the cave?

Lloyd Logan: No. Clayton never got into it. He picked up histoplasmosis from a cave in Florida when he was much younger than he was at the time and nearly died from it and his doctors advised him to stay out of the caves and so he had stayed out of caves. He was very interested in what was there, but he physically couldn't go into the cave himself because of health concerns. Arnie didn't go in at all either so I was the only Smithsonian representative and that was as a volunteer.

Vince Santucci: So did you have help from the Park Service or the Cave Research Foundation to remove material?

Lloyd Logan: Both. Ron Kerbo, and there were a couple of other guys from the Park Service, I cannot remember their names. I remember one was a blonde guy, about six feet tall that found

the dire wolf skull and he was really excited about that and then when I saw what he had, I was too because it was a beautiful skull. It was not much damage to it and we got one of the lower jaws as well.

Vince Santucci: The material that you removed from the cave did you collect most of the vertebrate material or only a portion of the vertebrate material?

Lloyd Logan: I collected what was readily apparent on the surface in the Big Room and then I went back the following spring in April, I think it was, and spent about 10 days down there and picked up anything else that I could find. I didn't go anywhere as you came down into the main room. As you came down, you're up against a wall or near a wall and there was a very high wall on the right side with an opening up toward the top and I went the other direction, I didn't go past that because I thought there wouldn't be a lot of fossils on the other side of that vertical wall. And I went down there and I spent about 10 days.

Lloyd Logan: I went to the Big Room and went over the material there, picked up a few things that had been overlooked at the first trip, picked up a couple of more pieces of the fossil mountain goat that was at the bottom of the breakdown pile that I think it was one of the park rangers that was helping me found that, it was either that or one of the Cave Research people found it while I was digging up the musk ox out of the pool.

Lloyd Logan: As you're getting ready to go down into the room where the muskox is, there was a little passage, as you were facing the room, hooked back to your right and went back in and there was a vertical shaft there and there, there was completely boulder choked and in that vertical shaft, in the breakdown at the bottom of that, is where I found the cheetah metapodial and the cheetah carnassial and the American lion metapodial and carnassial were both from that little breakdown chamber, probably, as I recall, it was maybe six feet in diameter and just totally full of breakdown.

Lloyd Logan: I wanted to do digging in there to see what was in there, but I was afraid I would create a boulder avalanche coming down there, just emptying that out and so I didn't do it, I just took what I could see from the surface. And then following along that same direction was a chamber that was actually fairly tall and there was a partial skeleton of a musk ox laying there on the floor and there was a big flat rock right where the head should be and I rolled that rock over and it had obviously fallen from the ceiling and landed right on top of the skull and the skull had to have been there for centuries before that happened because it was just powder. There was a powder outline in the shape of the skull, had about three teeth.

Vince Santucci: Did you get photographs of those things?

Lloyd Logan: I don't know. I don't think I photographed that. I just picked up the pieces and took them with me.

Vince Santucci: Okay. And all of the collections went to the Smithsonian and presumably are there today?

Lloyd Logan: Yes.

Vince Santucci: Okay. What was the plan once the collections were made to do with that material?

Lloyd Logan: Well, I was hired on a joint appointment from the Park Service and the Smithsonian to excavate the materials from the cave and identify them and prepare some things for exhibit. So the Park Service paid my salary and the Smithsonian provided me with a place to work and logistical support and things like that. So I had a year grant and then when I went back out in April and found a lot more small stuff it was extended for six months. I made molds of the musk ox's skull and jaws and a number of other pieces of it and cast them and sent them to the Park Service exhibits area out at – not from—

Vince Santucci: Harpers Ferry?

Lloyd Logan: Yeah, Harper's Ferry and they went out there to be photographed and then used in an exhibit at the park and I had cast them in epoxy and I found out over a year later that they had put them under lights to photograph them and then gone off to lunch and the lights got so hot that the epoxy melted and sagged down. When I cast it in the epoxy it was something we used for museum specimens all the time, but you don't expect them to sit under 120 degree lights and epoxy's not the most stable thing when it gets real hot and so they sank down and they weren't ever used in the exhibit.

Lloyd Logan: And I contacted Carlsbad several months after I sent that, after a year or so after I sent that out there, to see if they could send me pictures of the exhibit and got a really frosty reception and they said that they had never gotten any exhibit and were very upset about it. And I was taken aback because I knew I had sent the stuff out there and then through one of my friends that was working in the Park Service, I found out that they had actually melted the specimens and had they said anything to me, I could've recast them. It wouldn't have been a problem to recast them, but by the time they got back to me, the molds had been destroyed because there was no sense keeping a mold around that wasn't of a fossil that was recognizable other than being covered with flowstone and being a musk ox. So we didn't keep the molds like we would if it had been a perfectly clean specimen. So we've lost our chance on that one.

Vince Santucci: Yes. So were you actually working that year in Washington DC for the Smithsonian?

Lloyd Logan: Yes.

Vince Santucci: Okay.

Lloyd Logan: Yes, I moved to Washington DC and went into the Smithsonian every day and worked in there in the paleobiology department. I did all the preparation work on these fossils, all of them, they got prepared and also published that material in the—Let's see, where did I publish that? I think it was published the—I can't remember, too many years, but I did publish a laundry list of what I'd found in the cave somewhere, I don't remember where it was, but one

interesting thing was the cheetah fossil that I found there, they had just found cheetahs in Natural Trap Cave, Wyoming the previous year and it made the cover of Science Magazine and when I found the metapodial, I went through everything I knew from North America and nothing matched and so I went into the osteology department compared it a cheetah metapodial and it matched. Although I never published anything to that effect, the cheetah from Musk Ox Cave, to my knowledge, was the second locality for cheetahs in North America.

Vince Santucci: That's very exciting. So let's see, just a couple of other final thoughts. So did you sense any concerns from Ron Kerbo about removing the material from Musk Ox Cave?

Lloyd Logan: No, not really. I think his biggest concern was getting it out safely as mine was because we had to go up through that boulder choke and it was a very labor-intensive operation. We had an assembly line of people to haul it up and pull it up through each one of the ledgers and carry it out and get it up to the top of the surface and things so it was a labor-intensive act, but he didn't seem to be... Well, I think he may have preferred that it stay in the cave, but he saw that the scientific value of it was probably more than the value of keeping it in the cave and so he was perfectly willing to help and he was great to work with. There was never anything that I needed or asked for that he didn't help me with.

Vince Santucci: Perfect. Let's see so we have been able to take images of the skull and create a 3D model of it.

Lloyd Logan: Excellent.

Vince Santucci: And I can send you a link to a website where you'll be able to view that and actually when you load it on your computer, you can use your mouse and click and it'll rotate the skull so you'll be able to see it in three dimension.

Lloyd Logan: Wonderful. Yes, I would love to see that.

Vince Santucci: I'll do that after this call, I'll send you the link to that. Do you have any other final thoughts about anything that we discussed, anything I forgot to ask you?

Lloyd Logan: No, I think you pretty well covered it. I do think that further work in the cave, especially in the area that is directly below the modern entrance, I found the majority of the shrew material and other micro-vertebrates in that main rooms where you come down, there was a ledge up high and there was a little debris cone in the middle of that room and that's where I got the majority of the shrew material and things like that and I think that probably if someone were to go in there and work the sediments below that area, I didn't do an exhaustive search or excavation there by any means, I basically just did a skimming of the surface and then put everything that I found in bags and took it to the Smithsonian and then went through and picked it and got the vertebrates out of it and I think there might be a good bit more materials farther away from that area where it would have naturally migrated over time. So that's a potential there.

Vince Santucci: How about sampling for micro-vertebrates? Did you do any searches for some of the smaller materials?

Lloyd Logan: Only that one spot there that was below the ledge. There I could see a couple of owl pellets on the surface and so I figured that would be a good place to look and that's where I got all of the micro, I didn't do any search for micros anywhere else. If I saw them, I picked them up, but I didn't do any exhaustive looking for them.

Vince Santucci: Any reflection back now thinking about this today how this influenced your life?

Lloyd Logan: Well, definitely influenced my life. Got me to work at the Smithsonian for a year and a half and that led to another year of writing script for the paleontology department, the Conquest of Life Hall there. And indirectly, it influenced a good bit of the rest of my career because I saw a notice on the mammalogy bulletin board, they were looking for a mammalogist to do mammal surveys for the state of Georgia and in the Okefenokee Swamp, for the first endangered species surveys and I applied for that and ended up getting the job, but also while I was at the Smithsonian, I was right down the hall from Larry Isham's office.

Lloyd Logan: He was the scientific illustrator for the paleo department. And every time I'd walk by his place, I would stick my nose in the door and see what he was doing and asking him questions. And he finally said, "Lloyd, if you want to know about scientific illustration, know how to do it, why don't you take our summer workshop?" And I did the following year, that would be '77 and ended up teaching scientific illustration at the University of Georgia, I founded their scientific illustration program that's still going strong today and it's taught by one of my former students and the University of Georgia, after I left there after nine years, named an annual award, the Lloyd Logan Award of Excellence in Scientific Illustration after me to thank me for my services.

Vince Santucci: Wow.

Lloyd Logan: So the Musk Ox Cave thing and my volunteer work while I was in the army there really got me laying my career out. And while I was writing the script, I was in the exhibits department and I helped build some models there and I ended up working for Chase Studio for seven years as a supervisor in two different departments, building models for natural history exhibits and museums all over the world and then I worked three years at Taylor Studio and then I spent the last eight years of my career as the Director of Education and Exhibits at the Prehistoric Museum here in Price, Utah.

Vince Santucci: Wow. That is fantastic.

Lloyd Logan: Basically, the volunteer work I did in the army and Musk Ox Cave were both very instrumental in focusing my career.

Vince Santucci: Congratulations for that. That's pretty exciting. I was unaware of all that post Musk Ox Cave history and so congratulations.

Lloyd Logan: Thank you.

Vince Santucci: Do you still do illustrations?

Lloyd Logan: Yes, I do. I do a lot more three-dimensional stuff now. One of the things I did for Chase, is I did a life reconstruction of the short-faced bear, *Arctodus simus* and with full hair-on reconstruction for the Illinois State Museum and that was a lot of fun. I really enjoyed doing that.

Vince Santucci: I'm thinking, boy, "Wouldn't it be great to get a Lloyd Logan illustration of the Musk Ox Cave material?" Something to think about.

Lloyd Logan: Yeah. It could be done. So, just have to get me some material or actually I could do it from photographs, but I would rather have an actual specimen.

Vince Santucci: Sure. Well, we're coming up on one hour and so if you have any other last thoughts, that'd be great. Otherwise – oh, go ahead.

Lloyd Logan: No real last thoughts. If no one has done anything on those bats in New Cave, I may approach – they approached the Park Service about a possible research project there, I would have to find a museum to be affiliated with maybe the Prehistoric Museum here in Price after the current director leaves, he and I do not get along, he's a little bit on the micromanaging, well, a whole lot on the micromanaging side and I don't respond well to that, but it would be a fun project to work on those bats because I know that there's got to be some incredible information with all the bones that are there. It's just too many of them, not to be something exciting in there.

Vince Santucci: Well, I'll follow up with email introduction between you and Rod Horrocks. He's the chief of natural resources for Carlsbad Caverns National Park and we'll see where that goes.

Lloyd Logan: Alright. I'm retired now and I have lots of time on my hands so right now what I'm doing is fixing up my home. I got an old church, it's not a pretty building, just a big one that I'm converting into my home, a massive recycling project and once I get that done, I'll be looking for something else fun to do so be happy to do that. As a note, I just rejoined the Guild of Natural Science Illustrators, I was a member for about 25 years and then let my membership lapse and I've just rejoined and I'm going to be doing a presentation on rock art in this area at the meeting in Salt Lake this summer. So I am getting my foot back in the scientific illustration door.

Vince Santucci: Sounds great. We'll have to think about how we can take advantage of that.

Lloyd Logan: Sounds good to me Vince.

Vince Santucci: Well, I sincerely want to—

Lloyd Logan: Thank you very much for calling and letting me dredge up these memories, it's been wonderful. Made sure you feel warm and fuzzy to talk about all these old friends though.

Vince Santucci: Well, I can't thank you enough. This is something that really benefit us, I'm glad we captured this important historic story of the work you did and the resources at Carlsbad and Guadalupe and on behalf of myself and our National Park Service paleontology team, thanks so

much for all your help. I'll make sure I get you a copy of the transcript for the interview and then today I'll send you an email with a link to the photogrammetry model.

Lloyd Logan: Sounds great.

Vince Santucci: Thanks again for everything.

Lloyd Logan: Sure. Thank you, Vince.

Vince Santucci: Have a nice day. Bye.

Lloyd Logan: Bye.

[END OF INTERVIEW]

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 2020/002, February 2020

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U.S. Department of the Interior

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